UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO.   : 7,331,012

APPLICATION NO. : 10/634,723

ISSUE DATE   : February 12, 2008

INVENTOR(S)   : Bane Vasic et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

At col. 6, lines 28–31, please delete:

" 0*(111111111111111)+1*(0000000011111111)+1*(0000111100001111)+0*(0011001100110011)+ 0*(0000000000001111)+0*(0000000000110011)+0*(0000000001010101)=(0000111111110000). "

and insert therefore:

– – 0*(111111111111111)+1*(0000000011111111)+1*(0000111100001111)+0*(0011001100110011)+ 0*(0101010101010101)+0*(0000000000001111)+0*(0000000000110011)+ 0*(0000000001010101)=(0000111111110000). – –

At col. 6, lines 28–31, please delete:

"FIG. 3 illustrates a communication circuit 10 according to the present inventiow. The communication circuit 10 includes an RM-encoder 12, a partial-response channel 14, and a Reed-Muller partial response decoder 16 (RM-PR 16). For simplicity, a transmission of a single codeword m is shown, though the same principle of operation holds for every message word transmitted. As shown, codeword m is input into the RM encoder 12, which generates an RM-encoded codewordx. RM-encoded codeword x is transmitted over the Partial-Response (PR) channel 14, which tends to introduce noise to the codewordx such that the received codewordy contains unknown errors. As shown, the received codeword y is input into the RM-PR decoder 16, which produces an output decoded codeword."

and insert therefore:

– – FIG. 3 illustrates a communication circuit 10 according to the present invention. The communication circuit 10 includes an RM-encoder 12, a partial-response channel 14, and a Reed-Muller partial response decoder 16 (RM-PR 16). For simplicity, a transmission of a single codeword m is shown, though the same principle of operation holds for every message word transmitted. As shown, codeword m is input into the RM encoder 12, which generates an RM-encoded codeword x. RM-encoded codeword x is transmitted over the Partial-Response (PR) channel 14, which tends to introduce noise to the codeword x such that the received codeword y contains unknown errors. As shown, the received codeword y is input into the RM-PR decoder 16, which produces an output decoded codeword. – –

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At col. 9, lines 15–16, please delete:
" The interleaver 18 orders re-orders the RM-encoded codeword x prior to passing the codeword x to the partial-response channel 14. "
        and insert therefore:
– – The interleaver 18 randomly re-orders the RM-encoded codeword x prior to passing the codeword x to the partial-response channel 14. – –

At col. 10, lines 42–46, please delete:
" The BCJR or SOVA device 20A has no initial reliability vector $\lambda(\hat{m})$ associated with the received code word y, so the second input of the BCJR or SOVA device 20A is a reliability vector $\lambda(\hat{x})$ of value zero, providing no indication of reliability. "
        and insert therefore:
– – The BCJR or SOVA device 20A has no initial reliability vector $\lambda(\hat{x})$ associated with the received code word y, so the second input of the BCJR or SOVA device 20A is a reliability vector $\lambda(\hat{x})$ of value zero, providing no indication of reliability. – –

At col. 11, lines 34–35, please delete:
" corresponding to G_j (with) message word bits $x_s^{(j)}$ having index s such that "
        and insert therefore:
– – corresponding to G_j (with) message word bits $x_s^{(j)}$ having index s such that – –

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It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

At col. 11, lines 50–57, please delete:

" In each array P_s, each column shows the locations of the code bits to be added together to give an estimation of the message bit x_s. This addition is modulo-2 addition. In the hard-coding version, the message bit is determined by a majority vote among all 2^{m-j} estimations, (as described above), and the received code vector is updated according to the relation y ← y×x$^{(j)}$G$_j$, and then passed to the next decoding step (step j×1). "

and insert therefore:

– – In each array P_s, each column shows the locations of the code bits to be added together to give an estimation of the message bit $x_s^{(j)}$. This addition is modulo-2 addition. In the hard-coding version, the message bit is determined by a majority vote among all 2^{m-j} estimations, (as described above), and the received code vector is updated according to the relation y ← y + x$^{(j)}$G$_j$, and then passed to the next decoding step (step j+1). – –

At col. 11, lines 62–64, please delete:

$$ LLR(b_s) = \log\left(\frac{Probability\left(b_s = +1 \| y\right)}{Probability\left(b_s = -1 \| y\right)}\right) $$

and insert therefore:

$$ - -\; LLR(b_s) = \log\left(\frac{Probability\left(b_s = +1/y\right)}{Probability\left(b_s = -1/y\right)}\right)\; - - $$

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It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

At col. 12, lines 5–32, please delete:

"

$$\mu(\hat{m}_s^{i,j}) = -S_s^{i,j} \cdot \log\left\{ -\tanh\left(\frac{A_s^{i,j}}{2} \right) \right\} \qquad (1)$$

$$S_s^{i,j} = \prod_l sign\{u(\hat{x}_l^{i,j,s})\} \qquad (2)$$

where $\mu(\hat{x}_l^{i,j,k})$ is the LLR of the expression for the s-th message bit from the i-th equation in the j-th level, and where

$$A_s^{i,j} = \sum_l \log\left| \tanh\left(\frac{\mu(\hat{x}_l^{i,j,s})}{2} \right) \right|. \qquad (3)$$

and "

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At col. 12, lines 5–32, please insert therefore:

$$-- \quad \mu(\hat{m}_s^{i,j}) = -S_s^{i,j} \cdot \log\left\{-\tanh\left(\frac{A_s^{i,j}}{2}\right)\right\} \qquad (1)$$

where $\mu(\hat{x}_l^{i,j,s})$ is the LLR of the expression for the s-th message bit from the i-th equation in the j-th level, and where

$$S_s^{i,j} = \prod_l sign\{\mu(\hat{x}_l^{i,j,s})\} \qquad (2)$$

and

$$A_s^{i,j} = \sum_l \log\left|\tanh\left(\frac{\mu(\hat{x}_l^{i,j,s})}{2}\right)\right|. \qquad (3) \quad --$$

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It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

At col. 12, lines 56–63, please delete:

" In the hard decoding version (Reed algorithm), a message bit is determined by a majority vote, and the received code vector is updated using the expression $\underline{y} \leftarrow \underline{y} \times \underline{x}^{(i)} G_j$ given above, and then passed to the next decoding step. In the soft decoding version, prior to advancing to the next row of the decoder **16**, the updated message bit likelihoods must be converted to the code bit likelihoods. This conversion is performed based on the submatrix G_j. "

and insert therefore:

– – In the hard decoding version (Reed algorithm), a message bit is determined by a majority vote, and the received code vector is updated using the expression $\underline{y} \leftarrow \underline{y} + \underline{x}^{(i)} G_j$ given above, and then passed to the next decoding step. In the soft decoding version, prior to advancing to the next row of the decoder **16**, the updated message bit likelihoods must be converted to the code bit likelihoods. This conversion is performed based on the submatrix G_j. – –

At col. 13, lines 26–27, please delete:

"Suppose that the nonzero positions of the l-th column of G_j are given by the set $\{l_1 \ldots l\}$ where "

and insert therefore:

– – Suppose that the nonzero positions of the l-th column of G_j are given by the set $\{l_1 \ldots l_t\}$ where – –

At col. 13, lines 63–65, please delete: " $\lambda(\hat{x}_l) = \left[\prod_j sign\{u(\hat{m}_{ij})\} \right] \cdot \min_j \{| \mu(m_{ij}) |\}$ "

and insert therefore: – – $\lambda(\hat{x}_l) = \left[\prod_j sign\{\mu(\hat{m}_{ij})\} \right] \cdot \min_j \{| \mu(m_{ij}) |\}$ – –

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At col. 14, lines 46–56, please delete: "

$$m_{10} = c_0 + c_1 + c_{2+c3}$$
$$m_{10} = c_4 + c_5 + c_{6+c7}$$
$$m_{10} = c_8 + c_9 + c_{10+c11}$$
$$m_{10} = c_{12} + c_{13} + c_{14+c15}$$

"

and insert therefore: --

$$m_{10} = c_0 + c_1 + c_2 + c_3$$
$$m_{10} = c_4 + c_5 + c_6 + c_7$$
$$m_{10} = c_8 + c_9 + c_{10} + c_{11}$$
$$m_{10} = c_{12} + c_{13} + c_{14} + c_{15}$$

--

At col. 14, lines 63–66, please delete: "

$$P_{10} = \begin{bmatrix} 0 & 4 & 8 & 12 \\ 1 & 5 & 9 & 13 \\ 2 & 6 & 10 & 14 \\ 3 & 7 & 11 & 15 \end{bmatrix}$$

"

and insert therefore: --

$$P_{10} = \begin{bmatrix} 0 & 4 & 8 & 12 \\ 1 & 5 & 9 & 13 \\ 2 & 6 & 10 & 14 \\ 3 & 7 & 11 & 15 \end{bmatrix}$$

--

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At col. 15, lines 10–15, please delete: "
$$P_1 = \begin{bmatrix} 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 8 & 9 & 10 & 11 & 12 & 13 & 14 & 15 \end{bmatrix}$$ "

and insert therefore: − −
$$P_1 = \begin{bmatrix} 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 8 & 9 & 10 & 11 & 12 & 13 & 14 & 15 \end{bmatrix}$$

$$P_0 = [0 \ 1 \ 2 \ 3 \ 4 \ 5 \ 6 \ 7 \ 8 \ 9 \ 10 \ 11 \ 12 \ 13 \ 14 \ 15] \ − −$$

At col. 15, lines 20–30, please delete: "
$$P_5 = \begin{bmatrix} 0 & 4 & 8 & 12 \\ 1 & 5 & 9 & 12 \\ 2 & 6 & 10 & 14 \\ 3 & 7 & 11 & 15 \end{bmatrix}$$ "

and insert therefore: − −
$$P_5 = \begin{bmatrix} 0 & 4 & 8 & 12 \\ 1 & 5 & 9 & 13 \\ 2 & 6 & 10 & 14 \\ 3 & 7 & 11 & 15 \end{bmatrix}$$ − −

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